PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Application of the Multiphase Optimisation Strategy to develop, optimise and evaluate the effectiveness of a multicomponent initiative package to increase 2-to-5-year-old children's vegetable intake in long day care centres: A study protocol
AUTHORS	Zarnowiecki, Dorota; Kashef, Shabnam; Poelman, Astrid; Cochet-Broch, Maeva; Arguelles, Jennifer; Cox, David; Golley, Rebecca

VERSION 1 – REVIEW

REVIEWER	Toussaint, Nicole Amsterdam University of Applied Sciences, Faculty of Sports and Nutrition
REVIEW RETURNED	18-Jun-2021

GENERAL COMMENTS	Thank you for the opportunity to review the manuscript 'Application of the Multiphase Optimization Strategy to develop an initiative package to increase children's vegetables intake in childcare' for possible publication in BMJ Open. This study will use the Multiphase Optimisation Strategy to develop, optimise and evaluate the effectiveness of a multicomponent initiative package to increase children's (2-5 years old) vegetable intake in long day care centres. A particular strength is the use of the Multiphase Optimisation Strategy experimental design and this study protocol does seem to be an important addition to BMJ Open. The manuscript follows the SPIRIT statement and is well prepared. I have a few comments/suggestions that I would like to address: Title page: Line 2-3: In the title you use 'Optimization', while in de manuscript mainly 'Optimisation' is used. Please make sure to be consistent. Abstract: Line 36: Maybe add that it concerns children's vegetable intake and food group intake at day care. Line 37: Maybe explain who the staff is and what kind of knowledge and skills you will be examining. Introduction: Line 107-108: Here you use the terms 'multi-level' and 'multi-component', while in other parts of the manuscript you use 'multilevel' and 'multicomponent'. Please make sure to be consistent. Line 110: Who in this case are the staff? Line 114-116: Maybe you can improve the readability of this sentence. Paragraph 4-5: Maybe you can put even more emphasis on the innovative aspects of the study.

	Line 137: 1) → (1). Methods: Line 158: Why three initiatives? Line 170-171: Does it concern an existing online training module? Who developed/will develop this training? At the end of the methods section you have a 'Patient and Public Involvement Statement'. Maybe you can incorporate some information to the section about the 'Preparation Phase'? Line 198: Line 170-171: Does it concern an existing interactive online training module? Who developed/will develop this training? Can you give an example of interactive components? At the end of the methods section you have a 'Patient and Public Involvement Statement'. Maybe you can incorporate some information to the section about the 'Preparation Phase'? Line 226: Who are the 'early education experts'? Line 258-260: Does it concern written informed consent? Line 271: You can use the abbreviation LDC. Line 335-343: Maybe you can add some examples of questions in this paragraph to give more context. Line 402: So you also enrol kitchen assistants? Line 415-416: What are you planning to do with baseline differences? Line 436: 'optimized' → optimised. Line 445: 'optimization phase' → optimisation phase. Discussion: Line 527-529: In my experience at Early Childhood Education and Care settings, face to face contact can be very valuable. Did you consider adding some face to face contact (for example in the training module for educators so they can share experiences)? Line 530-537: Can you add some information about the generalisability of your findings?

REVIEWER	Lafave, Lynne Mount Royal University, Health and Physical Education
REVIEW RETURNED	21-Jun-2021

GENERAL COMMENTS	Manuscript #: bmjopen-2020-047618 Application of the Multiphase Optimization Strategy to develop an initiative package to increase children's vegetable intake in childcare Overall Early childhood is a crucial period for establishing healthy eating habits. With increased reliance by families on formal childcare, setting environments can provide a critical opportunity to shape children's food intake. Determining the optimal approach to achieving healthy eating habits and outcomes in formal settings requires a structured approach to assessment. While RCTs are often considered the golden standard in research design for medical health studies, public health interventions may benefit from more nuanced designs. The implementation of MOST (multiphase optimization strategy) is a novel approach in the early childhood education context that would benefit from the efficient and fiscally responsible MOST approach to health intervention assessment. The protocol is well prepared and clearly described. This study will contribute to body of knowledge in this area as well as providing information on the essential components that increase children's vegetable intake. It was a pleasure to review this well written and

	clearly described manuscript. I offer a few minor revision suggestions to consider. Minor comments: Abstract Line 29 – journal instruction to authors indicates the title is “Methods and analysis”. Line 29 – 39 - The methods are well described but analysis is not addressed. Consider how to include. Line 37 – consider the use of the oxford comma. The two ‘ands’ in the sentence create a sense of confusion. Consider the use of the oxford comma throughout the paper for clarity. Introduction Line 90 – add ‘those’ after including – “sector, including those for healthy eating.” Line 104 – you have included three different ways (fraction; weight; proportion) to express vegetable serving (one-quarter; grams; 0.07). In line 106 you compare these and inform the reader that intervening at an earlier age produces superior results. Consider using the same method to express the servings to help the reader quickly come to the same conclusion. Line 108, 113, 319, 533 – child care is written as two words. In sixteen other instances and in the manuscript title, childcare is written as one word. Choose one format and align all. Line 131– period is posted after citation reference number; whereas in most sentences the citation follows period. Check for consistency throughout manuscript. Methods and analysis Line 147 – should this be titled “Methods and analysis”? Line 185 – consider using a term to distinguish beans. Examples of beans (black beans, chick peas) or legumes/beans (as described in Line 184) to distinguish between these and green beans. E.g. “vegetables or cooked legumes/beans” Line 321 – it is unclear who will be doing the weighing of the food. Consider specifying who (educator or research team) will be doing the weighing for reader clarity. Line 322 to 326 - Will each food group be served in individual plates and weighed separately in order to be able to report weight by food group? Clarify for the audience. Line 403 - this is the first time the acronym ECEC is used within text (abbreviation provided in Table 2; SFS-ECEC). Consider defining acronym the first time it appears within text.

REVIEWER	Kugler, Kari Penn State, Biobehavioral Health
REVIEW RETURNED	27-Jun-2021

GENERAL COMMENTS	bmjopen-2020-047618 Title: Application of the Multiphase Optimization Strategy to develop an initiative package to increase children’s vegetable intake in childcare The following study protocol described the process to build an effective and efficient behavioral intervention to increase vegetable intake among children in long day care settings. It was very well written and easy to understand. Below are some suggestions for edits and questions for clarification.

	1) The application of the multiphase optimization strategy is well described; but there are a few areas for better description. a. Do not need to capitalize multiphase optimization strategy in context of sentence. b. "Initiative package" is awkward. Consider saying intervention or program instead of package. c. The optimization phase does not mean the best in an absolute sense. Rather it is a process to identify one of the best intervention combinations, subject to constraints. Thus, the authors need to identify an optimization criterion for which they will make decisions about which components will be included in the optimized intervention. At minimum, an optimization criterion should be only including intervention components that meet statistical significance. d. The argument on Page 5, lines 123-125, about traditional approaches to evaluating multicomponent interventions needs to be elaborated or removed. The RCT is the gold standard for evaluating the effectiveness of an intervention and thus is a part of MOST. Instead, a better argument is that solely relying on an RCT does not enable researchers to answer important questions about the independent and synergistic effects of intervention components, which is necessary to build an optimization intervention. e. Page 6, line 129, change "develop" to" build effective, efficient, and scalable" interventions. f. Page 6, line 135, MOST is a framework not a design, thus change to say, "This study will use a full factorial design during the optimization phase to identify which components, individually and in combination, produce the best intervention subject to constraints." g. Page 7 introduces the preparation phase which should include a conceptual model of how the identified intervention components are hypothesized to have an impact on primary outcome. It's recommended that this is included. h. Page 12, line 231 add the word full before factorial design. i. Page 12, line 232, change to say independent and combined effects. ii. j. Page 12, line 240, per comment "c" above, the results from the factorial design will allow the researchers to build an optimized intervention based on an a priori optimization criterion. This may not identify the best intervention/largest effect. For instance, say that only 2 components meet statistical significance and the third has some effect but does not. The largest effect would include all 3 components, but the optimized intervention would only include 2 and potentially would yield a smaller overall effect. k. Page 12, line 238, remove the control condition, as this is not applicable to full factorial designs. l. Page 20, line 408, report the number of kids/center as this is central to computing intraclass correlations.

	m. In reference to Page 21, line 420: Although the approach to decision making in the context of optimization trials is still in its infancy, there is a recommendation by Collins et al, 2014, where a fully saturated model is recommended first. See Collins, L. M., Trail, J. B., Kugler, K. C., Baker, T. B., Piper, M. E., & Mermelstein, R. J. (2014). Evaluating individual intervention components: making decisions based on the results of a factorial screening experiment. Translational behavioral medicine, 4(3), 238-251. n. With reference to the evaluation phase of this study, it is difficult to estimate sample size for an optimized intervention that has not yet been determined; however, more details should be given as to how the authors came up with an effect size of Cohen's D = 0.65. This is based on the expectation that all of the components will be included, but there is some overlap in their effects? The optimization trial is powered on an effect of Cohen's D = 0.31. Assuming all of the intervention components have that effect size, a completely additive model would be Cohen's D = 0.93. 2) During the Introduction the authors make the argument that 0-55% of long day care centers meet the guidelines for vegetable provisions, which brings into question about the mealtime intervention component that requires teachers to use supportive feeding practices to increase vegetable acceptable and intake. Will this be possible in centers where the center does not provide a variety of vegetables? 3) Page 17, the primary outcome for making decisions about effectiveness of intervention components should include additional information about the validity of the instrument as to whether this has been done in long day care centers before with the targeted age of children. It seems plausible that children would alter their intake with the labeled plates/cups and observing researchers picking up of the crumbs or food dropped. This may or may not be different for kids in centers that receive intervention components.

VERSION 1 – AUTHOR RESPONSE

REVIEWER 1 COMMENTS:

Comment	Response	Corresponding line in manuscript and changes made
Overall comment: Thank you for the opportunity to review the manuscript 'Application of the Multiphase Optimization Strategy to develop an initiative package to increase children's vegetables intake in childcare' for possible publication in BMJ Open. This study will use the	Thank you for the positive feedback on this manuscript.	

Multiphase Optimisation Strategy to develop, optimise and evaluate the effectiveness of a multicomponent initiative package to increase children's (2-5 years old) vegetable intake in long day care centres. A particular strength is the use of the Multiphase Optimisation Strategy experimental design and this study protocol does seem to be an important addition to BMJ Open. The manuscript follows the SPIRIT statement and is well prepared.		
Title Page: Line 2-3: In the title you use 'Optimization', while in de manuscript mainly 'Optimisation' is used. Please make sure to be consistent.	The manuscript has been updated to consistently use 'optimisation' / 'optimised'.	Updated throughout manuscript.
Abstract: Line 36: Maybe add that it concerns children's vegetable intake and food group intake at day care.	Line 36 (now line 41) has been updated to state that the primary outcomes relate to children's vegetable and food group intake at long day care.	Lines 41-42: Primary outcomes are children's vegetable intake and food group intake at long day care.
Abstract: Line 37: Maybe explain who the staff is and what kind of knowledge and skills you will be examining.	This description has been updated to state that staff here are cooks and educators. The word limit for the abstract prohibits more detailed explanation of knowledge skills.	Lines 42-43: Secondary outcomes are menu compliance with guidelines, cook and educator knowledge and skills, and reach.
Introduction: Line 107-108: Here you use the terms 'multi-level' and 'multi-component', while in other parts of the manuscript you use 'multilevel' and 'multicomponent'. Please make sure to be consistent.	The manuscript has been updated to consistently use 'multilevel' and 'multicomponent'	Updated throughout manuscript.

Line 110: Who in this case are the staff?	Line 110 (now line 117) has been updated to clarify that staff here are directors and educators.	Lines 117: Interventions which improved children's healthy eating behaviours in care have targeted a combination of nutrition policies and food provision,31 36 director and educator training,36 37 educators' nutrition knowledge and feeding practices,38 39 delivery of curricula and sensory education,31 36 38 role-modelling and observational learning.40 Further, providing training and embedding interventions into everyday routines of the childcare centre is likely to improve the sustainability of interventions.30
Line 114-116: Maybe you can improve the readability of this sentence.	This sentence has been revised to improve readability.	Lines 121-125: Best practice guidelines for designing interventions to increase children's vegetable intake emphasise the need for multilevel and multicomponent interventions, which target both individuals and the environment, have more than one target audience (i.e. educators, children), target vegetables (i.e. rather than healthy eating) and are of sufficient intensity and duration (at least six weeks duration, with weekly participant contact).32 41
Paragraph 4-5: Maybe you can put even more emphasis on the innovative aspects of the study.	The innovative aspects of the study have been elaborated in paragraph 5.	Lines 141-149: This study will use the MOST framework to develop and evaluate a multicomponent initiative package for use in LDC centres to increase children's vegetable intake while in care. The initiatives will use a paradigm that focuses on building acceptance and familiarity with vegetables, as a sustainable approached to increasing vegetable intake.44 This study will use a full factorial design during the optimisation phase to identify which components individually and in combination, produce the best initiative package subject to constraints. Utilising this approach will overcome limitations of studies testing either single intervention components or multicomponent interventions, that are unable to identify which component(s) or combination of components are most effective. This will support the development of feasible, efficient and effective initiative package that can

		be implemented in practice, without placing burden on LDC centres.
Line 137: 1) → (1).	Updated to (1)	Line 152
Methods: Line 158: Why three initiatives?	Guidelines for designing interventions to increase children's vegetable intake recommend that optimum interventions are multilevel and multicomponent, targeting both individuals (children – sensory learning and acceptance of vegetables via curriculum) and the environment (educator knowledge and skills; cook knowledge and skills to provide vegetable on the menu). Accordingly, the three initiatives address this recommendation for best practice intervention design. This has been clarified in the first sentence of this paragraph.	Lines 173-176: Three initiatives will be developed which draw on evidence for effective strategies for increasing vegetable intake and acceptance in the early years30 44 and align with best practice guidelines for increasing vegetable intake in LDC, which recommend multilevel and multicomponent interventions that combine strategies targeting children and the centre environment. 32 41
Line 170-171: Does it concern an existing online training module? Who developed/will develop this training? At the end of the methods section you have a 'Patient and Public Involvement Statement'. Maybe you can incorporate some information to the section about the 'Preparation Phase'?	The online training for cooks and menu assessment tool are existing resources developed by our partner organisation, Nutrition Australia. The training and menu planning tool were developed by dietitians with feedback from long day care centres. This has been clarified in the manuscript.	Lines 188-190: The online training and menu assessment tool were developed by dietitians, with feedback from long day care centres.
Line 198: Line 170-171: Does it concern an existing interactive online training module? Who developed/will develop this training? Can you give an example of interactive components? At the end of the methods section you have a 'Patient and Public Involvement Statement'. Maybe you can incorporate some information to the section about the 'Preparation Phase'?	The online training for educators was developed by a team of dietitians, working in both research and within the long day care sector, and with our adoption partner who delivers training and resources to the long day care sector. To further expand on the information provided in the patient and public involvement statement, we have added a sentence regarding who developed the training within the methods section. The interactive components include short quiz questions, questions for reflection and planning activities for action within the long day care centre. This has been described in the manuscript.	Lines 215-217: The training will be developed by a team of dietitians and researchers with knowledge of the long day care sector and a service delivery partner who delivers training and resources to the long day care sector. Lines 221-222: Examples of interactive components include short quiz questions, reflection questions and planning activities for action within the long day care centre.

Line 226: Who are the 'early education experts'?	Clarification has been provided about who 'early education experts are'.	Lines 246-248: The development process will engage early education experts, including researchers, early education teachers and dietitians with expertise in long day care, to ensure that the curriculum is appropriate and aligns with usual teaching practice and everyday routines in LDC.
Line 271: You can use the abbreviation LDC.	Long day care has been abbreviated to LDC here.	Line 300
Line 335-343: Maybe you can add some examples of questions in this paragraph to give more context.	Examples of questions from the knowledge scale and skills scale have been added to this paragraph.	Lines 378-382: The knowledge scale will evaluate awareness and familiarity with each of the initiatives (For example – agreement with statement 'I am aware of the goals of the menu planning guidelines'). The skills scale will evaluate the training and skills gained for each of the initiatives (For example – agreement with statement 'I have the skills needed to plan a menu according to the menu planning guidelines').
Line 402: So you also enrol kitchen assistants?	Kitchen assistants will not be enrolled into the study. Information about staff characteristics, including the number of kitchen assistants employed at the centre, will be collected via director questionnaires and staff questionnaires. This has been clarified within the paragraph describing covariates.	Lines 442-443: Staff characteristics will be collected via director and staff questionnaires, including number of staff employed and their role (i.e. cook, educator, kitchen assistant), hours worked per week, age, gender, years in current position as well as years employed in the early childhood education and care (ECEC) sector, and qualifications relevant to role.
Line 415-416: What are you planning to do with baseline differences?	This description of this analysis has been updated in the manuscript to improve clarity. For primary outcomes, linear mixed models will be adjusted for any identified differences between groups at baseline which are hypothesised to have an effect on the outcome. An alternate approach could be to undertake stratified analyses; however the sample size may not be sufficient to do this.	Lines 539-542: Descriptive statistics will be generated for baseline measures. For the primary outcome, linear mixed modelling will assess between group differences in vegetable intake at 12-weeks, controlling for baseline intake and potential confounding factors including any identified baseline differences between groups. The primary outcome will be analysed using intention-to-treat principles.
Line 436: 'optimized' → optimised.	Updated to 'optimised'	Line 536

Line 445: 'optimization phase' → optimisation phase.	The manuscript has been updated to consistently use 'optimisation' / 'optimised'.	Line 445 and throughout
Discussion: Line 527-529: In my experience at Early Childhood Education and Care settings, face to face contact can be very valuable. Did you consider adding some face to face contact (for example in the training module for educators so they can share experiences)?	Face-to-face contact can be valuable for sharing of experiences between educators, however it is more resource intensive and requires moderation. Accordingly, the cost of delivery of face-to-face training over digital training can have implications on scalability and sustainability. A recent evaluation of the Taste & Learn vegetable curriculum in the schools found that additional face-to-face training did not add value above online training (Poelman, 2021). These points clarifying the online delivery mode, have been included in the discussion. Reference: Poelman et al (2021). Teacher Evaluation of an Experiential Vegetable Education Program for Australian Primary Schools: Does Face-to-Face Training Add Value above Digital Training?. Nutrients, 13(5), p.1648.	Lines 575-581: While face-to-face delivery of training can be valuable for sharing of experiences between educators, it is more resource intensive and requires moderation without necessarily adding value above online training.69 The cost of face-to-face training can also have implications on limiting the potential for scalability and sustainability. Therefore, as our aim was to deliver an initiative package that would be sustainable and scalable outside of the research setting, online delivery was used.
Line 530-537: Can you add some information about the generalisability of your findings?	A sentence describing generalisability of the findings has been added in the discussion.	Line 589-590: This study will be conducted in private child care centres in two jurisdictions in Australia, limiting the generalisability of the findings outside of these jurisdictions.

REVIEWER 2 COMMENTS:

Comment	Response	Corresponding line in manuscript and changes made
Overall comment: Early childhood is a crucial period for establishing healthy eating habits. With increased reliance by families on formal childcare, setting environments can provide a critical opportunity to shape children's food intake. Determining the optimal approach to achieving healthy eating habits and outcomes in formal settings requires a structured approach to assessment. While RCTs are often considered the golden standard in research design for medical health studies, public health interventions may benefit from more nuanced designs. The implementation of MOST (multiphase optimization strategy) is a novel approach in the early childhood education context that would benefit from the efficient and fiscally responsible MOST approach to health intervention assessment. The protocol is well prepared and clearly described. This study will contribute to body of knowledge in this area as well as providing information on the essential components that increase children's vegetable intake. It was a pleasure to review this well written and clearly described manuscript. I offer a few minor revision suggestions to consider.	Thank you for the positive feedback on this manuscript.	
Abstract Line 29 – journal instruction to authors indicates the title is "Methods and analysis".	The heading in the abstract has been updated to "Methods and Analysis"	Line 34
Abstract Line 29 – 39 - The methods are well described but analysis is not addressed. Consider how to include.	A sentence summarising the analysis has been added to the abstract. The abstract has been edited to fit within the 300-word limit.	Lines 44-46: Repeated measures ANOVA with interaction effects (Optimisation phase) and linear mixed modelling (Evaluation phase) will test effects of the initiatives on vegetable intake.

Abstract Line 37 – consider the use of the oxford comma. The two 'ands' in the sentence create a sense of confusion. Consider the use of the oxford comma throughout the paper for clarity	An Oxford comma has been added in this sentence in the abstract. The paper has been reviewed and oxford comma introduced where relevant.	Line 43
Introduction Line 90 – add 'those' after including – "sector, including those for healthy eating."	'Those' has been added within this sentence.	Line 96: "…which outlines standards for the sector, including those for healthy eating."
Line 104 – you have included three different ways (fraction; weight; proportion) to express vegetable serving (one-quarter; grams; 0.07). In line 106 you compare these and inform the reader that intervening at an earlier age produces superior results. Consider using the same method to express the servings to help the reader quickly come to the same conclusion.	These values had been expressed as reported in the supporting references. For ease of interpretation, approximate gram weights have been provided for all values.	Lines 109-113: Interventions targeting improvements in vegetable intake in childcare settings have achieved small-moderate increases in intake ranging from one-quarter of a serve (approximately 19g) to 67g (approximately 0.89 serves, with 1 serve = 75g based on Australian recommendations).32-34 In comparison, school-based interventions with older children achieved increases of 0.07 servings of vegetables (approximately 6g),35
Line 108, 113, 319, 533 – child care is written as two words. In sixteen other instances and in the manuscript title, childcare is written as one word. Choose one format and align all.	The manuscript has been updated to consistently use 'childcare'.	Updated throughout manuscript.
Line 131– period is posted after citation reference number; whereas in most sentences the citation follows period. Check for consistency throughout manuscript.	This error has been fixed here and the manuscript has been reviewed to ensure that the period is consistently before the reference number throughout.	Line 140
Methods and analysis Line 147 – should this be titled "Methods and analysis"?	The title has been updated to be 'Methods and Analysis'.	Line 161
Line 185 – consider using a term to distinguish beans. Examples of beans (black beans, chick peas) or legumes/beans (as described in Line 184) to distinguish between these and green beans. E.g. "vegetables or cooked legumes/beans"	This sentence has been updated to distinguish legumes from green beans.	Line 200: "…and legumes/beans per day (1 serve = 75g vegetables or cooked legumes/beans, 1 cup of leafy greens)"
Line 321 – it is unclear who will be doing the weighing of the food. Consider specifying who (educator or research team) will	The description of the plate wastage method has been updated to reflect that research staff will be weighing the food.	Lines 355-356: Prior to each mealtime (morning tea, lunch, and afternoon tea) bowls/plates and cups will be labelled with

be doing the weighing for reader clarity.		ID stickers and weighed by research staff. As food is served each component of the meal will be weighed by research staff and weight recorded.
Line 322 to 326 - Will each food group be served in individual plates and weighed separately in order to be able to report weight by food group? Clarify for the audience.	Food component here refers to components of the meal, rather than food groups – for example bread, pasta, with meat sauce, milk. A description of the process used to generate weight by food group has been added to this section.	Lines 356 – 358: As food is served each component of the meal (e.g. bread, pasta with sauce, milk) will be weighed by research staff and weight recorded. Lines 361-365: Detailed information about recipes, including type and brands of foods, will be obtained from the centre cook. For mixed meals, recipes will be entered into FoodWorks Professional version 10 (Xyris Software Pty Ltd, Queensland, Australia) to determine proportional ingredient weights and used to calculate weight of intake by food group for each recipe.
Line 403 - this is the first time the acronym ECEC is used within text (abbreviation provided in Table 2; SFS-ECEC). Consider defining acronym the first time it appears within text.	The ECEC abbreviation has been spelled out within the text at first use.	Line 445

REVIEWER 3 COMMENTS:

Comment	Response	Corresponding line in manuscript and changes made
Overall comment: The following study protocol described the process to build an effective and efficient behavioral intervention to increase vegetable intake among children in long day care settings. It was very well written and easy to understand. Below are some suggestions for edits and questions for clarification.	Thank you for your feedback.	N/A
1) The application of the multiphase optimization strategy is well described; but there are a few areas for better description: a. Do not need to capitalize multiphase optimization strategy in context of sentence.	The capitalisation of multiphase optimisation strategy has been removed within the context of sentences.	Updated throughout manuscript.
b. “Initiative package” is awkward. Consider saying intervention or program instead of package.	We have considered the reviewer’s suggestion. However, we feel that the phrase ‘initiative package’ best describes the final product of the research – a multicomponent package of initiatives for use by long day care centres	Nil
c. The optimization phase does not mean the best in an absolute sense. Rather it is a process to identify one of the best intervention combinations, subject to constraints. Thus, the authors need to identify an optimization criterion for which they will make decisions about which components will be included in the optimized intervention. At minimum, an optimization criterion should be only including intervention components that meet statistical significance.	The description of the Optimisation phase has been updated to reflect that this phase will identify the best combination of initiatives for increasing children’s vegetable intake. The optimisation criterion has been determined based on a meaningful increase in the key outcome variable of vegetable intake, defined as an initiative effect greater than those currently seen in the literature (Hendrie, 2017). Accordingly, the optimisation criterion is the initiative or combination of initiatives that deliver an increase of more than 0.5 serves of vegetables, anticipating that this should also be a statistically significant increase. If there are multiple combinations that meet that criterion, user information from the process evaluation can be used to select the initiatives that have the least barriers to implementation. If none of the combinations of initiatives achieve the	Lines 254-257: The objectives will be to (1) evaluate the independent and combined effects of three initiatives to identify the optimised combination of initiatives for increasing children’s vegetable intake while in care Lines 263-270: The optimisation criterion is the initiative or combination of initiatives that deliver an increase of more than 0.5 serves of vegetables, anticipating that this should also be a statistically significant increase. The optimisation criterion has been determined based on a meaningful increase in the key outcome variable of vegetable intake, defined as

	optimisation criterion, the package will consist of the intervention elements that show a statistically significant increase in vegetable intake, taking into account results of the process evaluation. We have used the reference by Collins (2014) provided by Reviewer 3 (comment m) to confirm the definition of the optimisation criterion is appropriate. The description of the optimisation criterion has been updated in the manuscript. References: Collins et al (2014). Evaluating individual intervention components: making decisions based on the results of a factorial screening experiment. Translational Behavioral Medicine, 4(3), 238-251. Hendrie et al (2017). Strategies to increase children's vegetable intake in home and community settings: a systematic review of literature. Maternal & Child Nutrition;13(1):e12276	an initiative effect greater than those currently seen in the literature.32 54 If none of the combinations of initiatives achieve the optimisation criterion, the package will consist of the intervention elements that show a statistically significant increase in vegetable intake, taking into consideration findings of the process evaluation.
d. The argument on Page 5, lines 123-125, about traditional approaches to evaluating multicomponent interventions needs to be elaborated or removed. The RCT is the gold standard for evaluating the effectiveness of an intervention and thus is a part of MOST. Instead, a better argument is that solely relying on an RCT does not enable researchers to answer important questions about the independent and synergistic effects of intervention components, which is necessary to build an optimization intervention.	This sentence has been modified to improve the description of the limitations of the RCT for the evaluation of multicomponent interventions.	Lines 133-136: Although the RCT is the gold standard for evaluating the effectiveness of interventions, evaluation of multicomponent interventions solely via RCT does not provide information about the independent, relative and synergistic effects of intervention components.
e. Page 6, line 129, change “develop” to” build effective, efficient, and scalable” interventions.	‘Develop’ has been change to ‘build effective, efficient and scalable’.	Line 137: “To overcome these limitations, the multiphase optimisation strategy (MOST) uses a multiphase experimental design to build effective, efficient and scalable multicomponent behavioural interventions.”
f. Page 6, line 135, MOST is a framework not a design, thus change to say, “This study will	This recommended sentence has been added and MOST study design has been updated to MOST framework.	Lines 143-148: This study will use the MOST framework to develop and

use a full factorial design during the optimization phase to identify which components, individually and in combination, produce the best intervention subject to constraints."		evaluate a multicomponent initiative package for use in LDC centres to increase children's vegetable intake while in care…This study will use a full factorial design during the optimisation phase to identify which components individually and in combination, produce the best initiative package subject to constraints.
g. Page 7 introduces the preparation phase which should include a conceptual model of how the identified intervention components are hypothesized to have an impact on primary outcome. It's recommended that this is included.	The conceptual model is provided in Figure 1.	Refer to Figure 1.
h. Page 12, line 231 add the word full before factorial design.	'Full' has been added before factorial design	Line 253: The optimisation phase will use a full factorial design to test the efficacy of the three initiatives for increasing vegetable intake in LDC centres
i. Page 12, line 232, change to say independent and combined effects.	The wording of objective 1 has been revised to say 'independent' and 'combined'.	Lines 254-255: "The objectives will be to (1) evaluate the independent and combined effects of three initiatives to identify the optimal package of initiatives for increasing children's vegetable intake while in care…"
j. Page 12, line 240, per comment "c" above, the results from the factorial design will allow the researchers to build an optimized intervention based on an a priori optimization criterion. This may not identify the best intervention/largest effect. For instance, say that only 2 components meet statistical significance and the third has some effect but does not. The largest effect would include all 3 components, but the optimized intervention would only include 2 and potentially would yield a smaller overall effect.	The language in this sentence (now line 258), has been revised to reflect that the optimised intervention package for increasing children's vegetable intake will be identified.	Lines 260-263: This study design maximises the statistical power to identify the main effect of each individual initiative, as well as additive and synergistic effects of initiatives to identify the optimised initiative package that is efficient, scalable and effective for increasing children's vegetable intake.
k. Page 12, line 238, remove the control condition, as this is not applicable to full factorial designs.	Reference to the control condition here has been removed.	Line 260: LDC centres will be randomly assigned to eight experimental conditions

		resulting from the crossing of the three initiatives, each of which has two conditions (present versus not present) and reflecting all possible combinations of initiative components (Figure 2).
l. Page 20, line 408, report the number of kids/center as this is central to computing intraclass correlations.	The number of children per centre (approximately 20 children per centre) has been added.	Lines 448-450: From prior research we assume an intraclass correlation coefficient of 0.1 for clustered data, with approximately 20 children per centre.47
m. In reference to Page 21, line 420: Although the approach to decision making in the context of optimization trials is still in its infancy, there is a recommendation by Collins et al, 2014, where a fully saturated model is recommended first. See Collins, L. M., Trail, J. B., Kugler, K. C., Baker, T. B., Piper, M. E., & Mermelstein, R. J. (2014). Evaluating individual intervention components: making decisions based on the results of a factorial screening experiment. Translational behavioral medicine, 4(3), 238-251.	Thank you to the reviewer for guiding us to this reference, which will be useful to inform decision making around selection of intervention components.	Nil
n. With reference to the evaluation phase of this study, it is difficult to estimate sample size for an optimized intervention that has not yet been determined; however, more details should be given as to how the authors came up with an effect size of Cohen's D = 0.65. This is based on the expectation that all of the components will be included, but there is some overlap in their effects? The optimization trial is powered on an effect of Cohen's D = 0.31. Assuming all of the intervention components have that effect size, a completely additive model would be Cohen's D = 0.93.	As the reviewer has noted, it is expected that there will be some overlap in effects and that the effect size achieved by each initiative will not be even. That is, one initiative may achieve a larger increase in vegetable intake than the other initiatives. Therefore, the effect size was calculated based on the hypothesised effect of an increase of 0.5 serves of vegetables of the total intervention package. This hypothesised effect size which can be achieved by the initiative package was determined from existing literature, which shows variable effect sizes ranging from 0.1-0.5 serves of vegetables (Bell 2015, Hendrie 2017 (Bell 2015, Yoong2019). This sample size calculation will be confirmed at completion of the optimisation phase. The explanation of the effect size used for the sample size calculation for the evaluation phase has been updated for clarity.	Lines 529-532: The sample size calculation was determined based on the hypothesised effect of an increase of 0.5 serves of vegetables from the optimised initiative package identified in the optimisation phase. An effect size of d=0.65 was calculated based on this hypothesised effect on vegetable intake and using standard deviation from prior research in Australian childcare centres.47 Lines 535-536: The sample size calculation will be confirmed at completion of the optimisation phase, when the effect size of the optimised

	References: Bell et al (2015), Impact of a nutrition award scheme on the food and nutrient intakes of 2- to 4-year olds attending long day care, Public Health Nutrition, vo.18(14), pp.2634-2642 Hendrie et al (2017). Strategies to increase children's vegetable intake in home and community settings: a systematic review of literature. Maternal & Child Nutrition;13(1):e12276 Yoong et al (2019), The Impact of a childcare food service intervention on child dietary intake in care: An exploratory cluster randomized controlled trial, Quantitative Research, vol.33(7), pp.991-1001	initiative package is determined.
2) During the Introduction the authors make the argument that 0-55% of long day care centers meet the guidelines for vegetable provisions, which brings into question about the mealtime intervention component that requires teachers to use supportive feeding practices to increase vegetable acceptable and intake. Will this be possible in centers where the center does not provide a variety of vegetables?	The reviewer has raised an interesting point, which will be considered when interpreting the study findings. While 0-55% of long day care centres do not meet the guidelines, this does not mean that no vegetables are provided on the menu. Therefore, improvement in vegetable intake without increase in the provision of vegetables on the menu should be possible.	Nil
3) Page 17, the primary outcome for making decisions about effectiveness of intervention components should include additional information about the validity of the instrument as to whether this has been done in long day care centers before with the targeted age of children. It seems plausible that children would alter their intake with the labeled plates/cups and observing researchers picking up of the crumbs or food dropped. This may or may not be different for kids in centers that receive intervention components.	Plate waste is considered a gold standard method for measurement of dietary intake as it uses direct observation and is not subject to recall or memory bias. Plate waste methodology has been used previously to assess food intake of children at childcare (Bell 2015, Seward 2016, Yoong 2019) and has been shown to be a valid method for assessing food intake with school children (Jacko 2007). It is possible that children may alter their food intake during meals due to the presence of the researchers at mealtimes, the labelling of plates/cups and disruptions to the usual serving of food due to the weighing of plates/bowls. To minimise this risk, the usual mealtime practices of the centre will be adhered to (e.g. educators serving, progressive mealtimes),	Lines 346-354: Children's vegetable intake will be assessed within the context of total food intake while in care, estimated using the plate wastage method which is considered a gold standard method for assessment of dietary intake as it uses direct observation and is not subject to recall or memory bias. Plate wastage methods have been used previously to asses food intake in childcare.25 47 57 Standardised data collection procedures will be followed in all centres. To minimise any potential effects of labelling plates/cups and the presence of research assistants on

	researchers will stand off to the side, avoid interacting with children at mealtimes and will not provide any encouragement to children regarding their food intake. A standardised protocol will be followed in all centres; therefore these potential effects will be even across all centres. References: Jacko et al (2007), Use of the plate-waste method to measure food intake in children, *Journal of Extension,* vol.45(6). Bell et al (2015), Impact of a nutrition award scheme on the food and nutrient intakes of 2- to 4-year olds attending long day care, *Public Health Nutrition*, vo.18(14), pp.2634-2642 Seward et al (2016), Multistrategy childcare-based intervention to improve compliance with nutrition guidelines versus usual care in long day care services: a study protocol for a randomised controlled trial, *BMJ Open;* vol.6e010786 Yoong et al (2019), The Impact of a childcare food service intervention on child dietary intake in care: An exploratory cluster randomized controlled trial, *Quantitative Research,* vol.33(7), pp.991-1001	children's intake, usual mealtime practices of the centre will be adhered to (e.g. educators serving, progressive mealtimes), researchers will stand off to the side, avoid interacting with children at mealtimes and will not provide any encouragement to children regarding their food intake.

VERSION 2 – REVIEW

REVIEWER	Lafave, Lynne Mount Royal University, Health and Physical Education
REVIEW RETURNED	22-Aug-2021

GENERAL COMMENTS	Thank you for your invitation to review this manuscript again. The authors have revised the article to my satisfaction.